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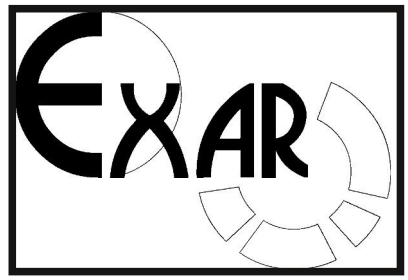

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40 Years of Underground Experiments

Getting to know the prehistoric Hallstatt salt mine with the aid of experimental archaeology

Hans Reschreiter

Zusammenfassung – 40 Jahre Experimente im Untergrund. Die Annäherung an den prähistorischen Salzbergbau Hallstatt mit Hilfe der Experimentellen Archäologie.
Der Hallstätter Salzberg zeichnet sich durch die perfekten Erhaltungsbedingungen für Objekte aus organischen Materialien aus. Die Untersuchungen der Prähistorischen Abteilung des Naturhistorischen Museums Wien seit 1960 brachten unter anderem über 1000 gebrochene Pickelstiele, etliche Schuhe, Kappen und Tragsäcke und hunderte Fragmente von anderen Gegenständen aus Fell, Haut und Leder, hunderte Textilfragmente, Schnüre und Seile aus Bast, Holzgefäße und Leuchtspäne und menschliche Exkremente zu Tage.
Viele Stücke haben sich nur in diesem Bergwerk erhalten, obwohl sie ursprünglich in weiten Teilen Europas verbreitet waren. Dadurch fehlen sehr häufig Vergleichsfunde. Um diesem unbefriedigenden Umstand zu begegnen, machte Fritz Eckart Barth bereits in den 70er Jahren aus der Not eine Tugend und wählte die Methode der Experimentellen Archäologie, um mehr über „seine" Funde und Befunde herauszufinden.
Die Vielfalt des Fundspektrums führte in den letzten Jahren auch zu einem breiten Spektrum an Versuchen und Experimenten, das von Salzabbau bis -transport, von Speisen und deren Konservierung, Zubereitung und Verzehr bis Beleuchtung reicht. Viele der dadurch gewonnenen Daten fließen in Computersimulationen ein, die als Ziel haben, die Arbeitsabläufe und die Ökonomie der prähistorischen Bergwerke und ihrer Umgebung zu verstehen.
Viele Experimente erfolgen eingebettet in den Ausgrabungsalltag – was einen direkten Rückfluss der Ergebnisse an die Ausgrabung gewährleistet. Der Resultate sind unter anderem auch die Basis für die vielfältigen Vermittlungsprogramme rund um die Hallstätter Bergwerke, fließen in die Lebensbilder ein und stellen oft auch den Startpunkt für interdisziplinäre Forschung dar.

Schlagworte: Experimentelle Archäologie, Bergbau, Hallstatt, Eisenzeit, Bronzezeit, Salz, Kochen, Transport, Vermittlungsarbeit
Keywords: Experimental archaeology, mining, Hallstatt, Iron Age, Bronze Age, salt, food preparation, transport, public outreach

Introduction

Starting from the very first systematic excavation of the Hallstatt salt mine in 1846, the superb preservation of organic prehistoric objects discovered stood out. Investigations led by the Prehistoric Department of the Museum of Natural History since 1960 brought to light hundreds of pick handles, many shoes, caps and carrying sacks, and hundreds of textile fragments, strings and ropes made of bast, wood vessels and lightning tapers, human excrement, broken pick tips, unusual pig bone ensembles and much more. The majority of the finds and features from the Hallstatt salt mine survived thousands of years, thanks to the saline conditions in the mine.

Many types of artifacts were preserved exclusively in this mine, although they were originally broadly distributed throughout Europe. For example, many situla pictures show that in the early Iron Age, caps made of fur were the height of fashion – pieces of this widely used clothing type were, however, only conserved in the Hallstatt salt mines, saved by the preservative effects of salt. In addition, the oldest backpacks known in Europe, the oldest leather hand protectors and finger stalls, and most of the known small, light wooden boxes from prehistoric times were found in the Hallstatt salt mine.

The uniqueness of many finds from the salt deposit make it extremely exciting to work in Hallstatt, however it also presents enormous challenges – not only during the excavation, storage and processing of the finds (Reschreiter et al. 2014) but also in their interpretation.

Although they may only be thousands-year-old garbage, many artifacts are in and of themselves a small scientific sensation. However, the understanding of and publicity for such unique finds is made much more difficult through their fragmented state.

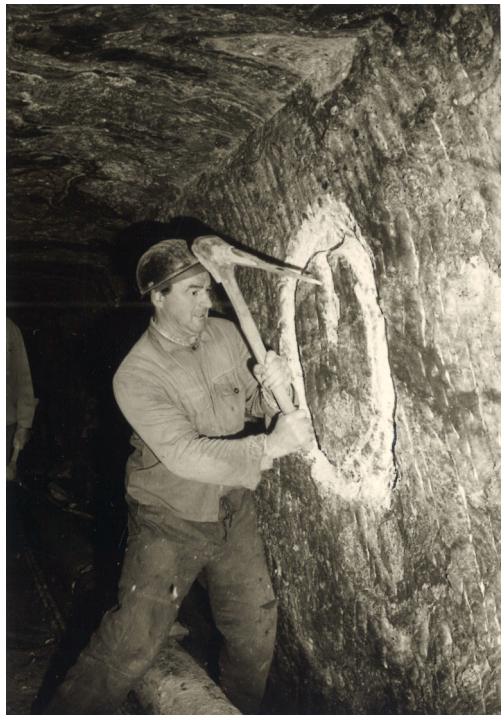

Fig. 1: The first quarrying experiments were carried out in 1973 and 1974 in cooperation with the German Mining Museum. – Gemeinsam mit dem Deutschen Bergbaumuseum wurden 1973 und 1974 die ersten Abbauversuche mit Bronzepickeln im Hallstätter Salzberg durchgeführt.

The uniqueness of the artifacts also entails an inability to compare them to finds from other excavation sites. This makes building models concerning the function and use of the artifacts difficult, as Barth remarked beginning in 1973 (Barth 1973, 153).

In order to grapple with such dissatisfying conditions, Barth made lemonade from the lemons, starting in the 70's when he chose the methods of experimental archaeology to research more about 'his' finds and features.

History of the experiments

The first publicized experiments from the

Fig. 2: Several large log-basins were discovered in the Hallstatt Salzberg Valley. In the course of the EU project "Archaeolive" one of these basins was reconstructed on one of the original sites by Eckart Barth and Wolfgang Lobisser and his team. – Mehrere große Becken in Blockbautechnik wurden am Hallstätter Salzberg entdeckt. Im EU Projekt Archeaolive wurde von Eckart Barth und Wolfgang Lobisser und dessen Team eine Pöckelwanne am Originalfundplatz nachgebaut.

Hallstatt salt mine were concerned with the use of bronze picks and the reconstruction of the quarrying technique of the early Iron Age miners (Barth 1976) (*Fig. 1*).
Afterwards, reconstructions were made of the discovered shoes, the main diet of the Hallstatt miners was recreated based on analysis of perfectly preserved excrement found in the mines, and the Bronze Age production of salt pork was reconstructed. Archaeological work on the shoes was put together in a combined presentation of all known shoe finds from Hallstatt (Barth 1992a) which incorporated the knowledge won out of creating the reconstructions. Barth then successfully reconstructed a prehistoric dish known as Ritschert and presented what was known about the nutrition of the miners in an exhibition (Barth 1992b). To this day, this stew – made of millet, barley, beans and meat – is the only authentic prehistoric dish, which can be demonstrably proven to have existed. The investigation of Bronze Age production of salt pork in Hallstatt was begun as part of a large EU project (Barth, Lobisser 2002). This promising, ambitious project included the reconstruction of a salting basin for pork and was completed with the presentation of its complete findings and an archaeozoological analysis (Pucher et al. 2012) (*Fig. 2*).
Such investigational efforts and experiments have been conducted from the 1970's to the present day and their bandwidth has been continuously expanded.

The context of the experiments and investigational efforts

Many of the experiments and investigational efforts that concern Hallstatt are

carried out within the framework of the annual excavations in the mine. Investigational work is partially carried out by the excavation team, or realised by archaeotechnicians with the participation of excavation team members. Hallstatt is therefore one of the few places where investigations are conducted as part of daily excavation work – which has the advantage that the experiences and results of those investigations flow right back into the excavation. The embedding of experimental work within excavation work also makes it possible for new finds and features to immediately be used as a basis for further investigational efforts. The long detour that comes with publication is not necessary, and the finds and features can be referred to for further questions at any given moment.
Furthermore, the embedding of experiments within excavation work makes it possible for them to be carried out at any time with the original material salt or haselgebirge (northern Alpine salt conglomerate) inside the mine.

Fig. 3: The Archaeological Center houses two workshops for experimental work. – Im Ausgrabungsquartier in Hallstatt stehen zwei Werkstätten zur Verfügung.

Infrastructure in the Salt Valley

Investigational efforts and experiments can be carried out at a very advanced level, thanks to the generous support of Salinen Austria AG and Salzwelten GmbH, who made it possible to open two well-equipped workshops in the old mine forge. The old forge is now an official field office of the Natural History Museum and serves between April and November as a base for archaeological work in Hallstatt. Eckhart Barth laid the cornerstone for this outstanding situation. Even back in his private cabin, that was used until 1994 as basecamp for the excavation, every kind of tool for working with wood was available. Then, as the cabin became too small for the intensity of the work in the Hallstatt High Valley (Salzbergtal), we were able to get the predecessor to the current field office on its feet in 1995. There, a small workshop for investigational efforts and experiments was put together and Eckart wrote in the cabin's log that the new quarters themselves ought also to be used for experiments. When in 2000 these quarters, however, were needed for other internal purposes, the opportunity to move operations to the nearby (and much bigger) old forge arose. The entire building was completely renovated with considerable effort by Salinen Austria AG and Salzwelten. The Natural History Museum provided comprehensive interior furnishings and equipment, and the new quarters were opened for use in 2001/2002. With the help of Wolfgang Lobisser, among many others, the workshops were set up and immediately put to use. Today

there is a blacksmith's workshop and a woodworking workshop in these quarters (*Fig. 3*).
Investigational efforts concerning “Hallstatt topics” are not just carried out in the Hallstatt High Valley (Salzbergtal) alone. There is also work being done on prehistoric mines as part of the university field seminar “Experimental Archaeology” (University of Vienna) held in the open air museum MAMUZ Schloss Asparn/Zaya, in the workshop of the Viennese Workgroup for Experimental Archaeology of the ÖGUF, in other “archaeotechnological” workshops and in the workshops of the Holzfachschule Hallstatt (technical woodworking college in Hallstatt) (Reschreiter, Barth 2005, 31).

Topics addressed up to now

Quarrying experiments
Quarrying experiments have been a popular choice for scientists since the very first tests in the 70's. As part of several experiments in the mine, the handling of a miner's toolset, as well as wear on bronze pick-ends was investigated (Grasböck 2009). The starting point for this work was centred on experiments with early Iron Age picks. Since then, Bronze Age and early Iron Age winged bronze picks (Lappenpickel) and also the Bronze Age socketed picks have been reconstructed and tested.
Quarrying experiments are usually conducted with reconstructed leather hand protectors. Alternative striking techniques, as suggested by the sharp mounting angle and the quite long and extremely thin haft of original Bronze Age handles, are also tested. The paleaobotanist Pavel Tarasov from the Freie Universität Berlin noticed a similarity between southern Russian scythes and prehistoric picks, which indicated to him the picks might have been used with a swinging motion from the hip, with an additional turning motion

Fig. 4: The very distinctive shape of the Bronze Age shafts – very thin and long handles – indicates a special and very efficient quarrying technique. – Der sehr dünne und lange Stiel der bronzezeitlichen Pickelstiele in Kombination mit dem spitzen Arbeitswinkel macht eine ungewöhnliche, aber sehr effiziente Schlagtechnik wahrscheinlich.

in the wrist closest to the pick's end (*Fig. 4*).
Again and again in the Bronze Age Hallstatt mine, it stood out that the picks were found with bent handles. To find out how this oldest systematic use of intentionally bent wood artifacts must have looked, comparisons were made with modern bentwood, and experiments conducted (Winner 2010; Grabner et al. 2015).
The work of Ralf Totschnig also has to do with pick handles. As part of his proseminar work, the reason for the countless marks made by tools on broken pick

handles was explained. It could conclusively be shown that the marks were made by thousands of blows on the handles, which were used as a secondary layer under something that was repeatedly hacked – what, however, was hacked up or chopped off remains unexplained (Totschnig 2008; Reschreiter, Grömer, Totschnig 2009; Reschreiter, Pany-Kucera, Gröbner 2013, 32).

Transport

Following the first step in the production of salt – the quarrying out of the salt – comes its transport, which represents another focal point of the work done in Hallstatt. In this broad subject area, attempts are made to reconstruct every step of the transport of salt from its mining site up to the surface. In the Bronze Age Hallstatt mine, the majority of transport was achieved using sophisticated wooden stair structures, that in this particular form are only known from the Hallstatt mine (Reschreiter, Barth 2005). The stairs' construction has subsequently been re-

Fig. 5: The leading edges of the steps show signs of heavy wear. Use wear experiments were conducted to investigate how the staircase was used 3000 years ago. – Die Vorderkanten der Auftritte der Holzstiege aus dem Salzbergwerk Hallstatt zeigen starke Abnutzungsspuren. Um die Nutzung der Treppe vor über 3000 Jahren zu verstehen, wurden mehrfach Abnutzungsversuche durchgeführt.

Fig. 6: In the early Iron Age mining phase the earliest known rucksack – made of untanned goat and sheep hide – was used. – Im Hallstätter Salzberg war in der älteren Eisenzeit die Urform des Rucksacks im Einsatz – gefertigt aus ungegerbten Ziegen- und Schafbälgen.

constructed multiple times, and an attempt was also made to understand the mechanical wear on the stair steps, as part of a university field seminar in MAMUZ Asparn/Zaya (*Fig. 5*).

Transport over these wooden stairs was achieved with carrying sacks made of untanned cowhide that feature a unique carrying device (Barth 1992c). Several modern copies of these sacks were created by Wolfgang Lobisser (Lobisser 2006). Extensive tests of the construction of the sacks were carried out by Matthias Kucera and Max Bergner (Kucera 2006). Barth has presented and tested cloth reconstructions of early Iron Age backpacks originally made of goat- and sheephide –

the oldest backpacks in Europe (Barth 1995, 82). Extensive test runs are currently being conducted as to the replication and use of such sacks made of untanned goat- and sheephide (http://hallstatt-forschung.blogspot.co.at/2016/09/hut-stock-ziegensack-eine-wanderung-auf.html) (*Fig. 6*).

Likewise, the many very thick wool textile fragments found in the Bronze Age Hallstatt mine are thought to be the remains of transport devices (Grömer, Reschreiter, Rösel-Mautendorfer 2013, 122). Many reconstructions of wool blankets and sacks were prepared by Lena Hammarlund (Göteborg) and tested in the mine.

Salt was brought up the central shafts of the Bronze Age Hallstatt mine with the aid of thick linden-bast ropes. The production and use of ropes and strings made of bast fibres has occupied us in Hallstatt for many years. Spurred on by our many finds, our initial experiences at the

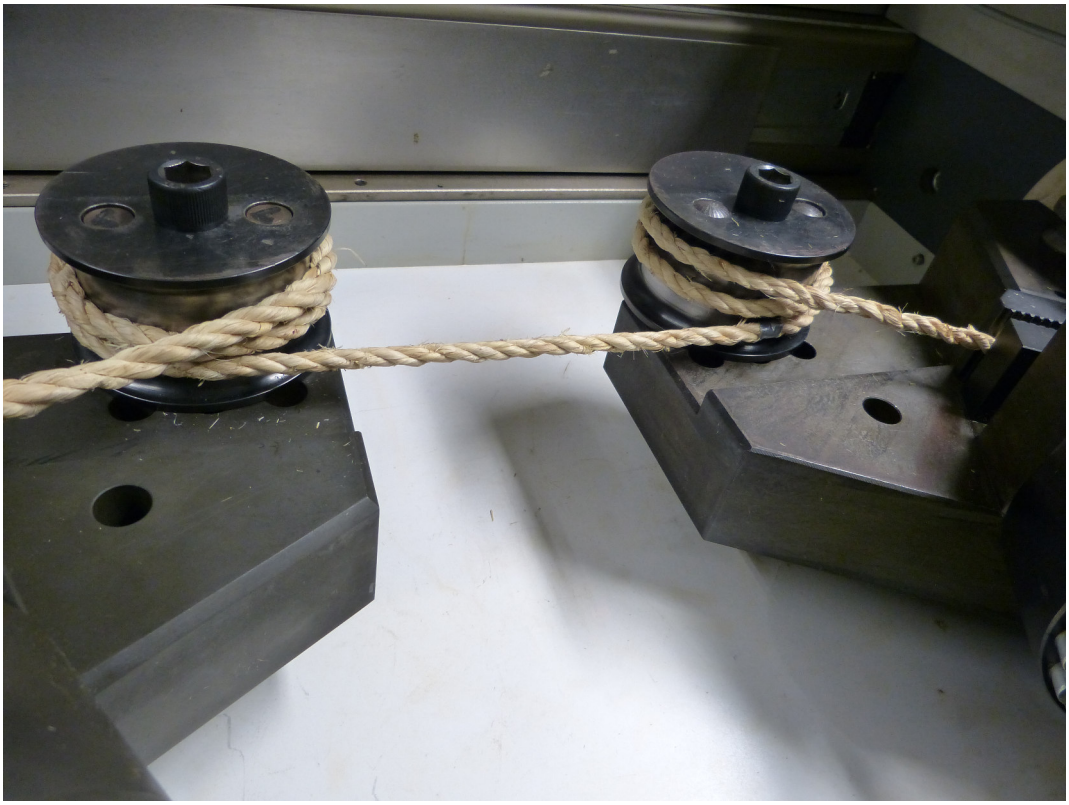

Fig. 7: The thickest ropes known in European prehistory were used in the Hallstatt salt mines. Carrying capacity, production time and effort, production technique und robustness are being tested through experiments and in projects with African rope makers. Robustness was tested at the Technical University of Chemnitz in cooperation with Arc-Tech and the State Museum for Archaeology Chemnitz. – Die dicksten Seile, die in der europäischen Urgeschichte bekannt sind, stammen aus dem Salzbergwerk Hallstatt. Durch Rekonstruktionen und deren Test und in Projekten mit westafrikanischen Seilern werden Tragfähigkeit, Arbeitsaufwand, Herstellungstechnik und Haltbarkeit der Seile untersucht. Belastungstest an der Technischen Universität Chemnitz in Kooperation mit Arc-Tech und dem staatlichen Museum für Archäologie in Chemnitz.

MAMUZ Asparn/Zaya, and through contact with ropemakers in West Africa (VAN DER STEGE ET AL. 2012) our occupation with bast rope-making became more and more intensive (LÖCKER, RESCHREITER 2005; GABRIEL 2008). It found a temporary endpoint in a cooperative effort with the museum, which fulminated in the reconstruction of a triple-braided rope with a 4 cm diameter, which could be strength-tested on the machines at the Technical University Chemnitz (https://www.youtube.com/watch?v=-NdjwjEB 6is; http://hallstatt-forschung.blogspot.co.at/2015/07/bast-so-der-film.html) (*Fig. 7*).
Subsequently, as part of a baccalaureate thesis, differing variations of freight conveyance with ropes were discussed; with a winch and with an idler pulley.
A short time ago, an extensive school class project took up the subject of the transport of mine timber to the mine. As part of the funding pool "Sparkling Science", supported by the Federal Ministry of Science, Research and Industry, various transportation methods for carrying mine timber were tested, based on information gathered by observing mechanical wear on prehistoric mine timbers (http://holz-fuer-salz.blogspot.co.at/p/uber-das-projekt_16.html) (RUDORFER, RESCHREITER 2014). As part of this project, and in further experiments, the Bronze Age technique of felling trees could be reconstructed (RESCHREITER, TOTSCHNIG, GRABNER 2010) (*Fig. 8*).

Fig. 8: In the course of the Sparkling Science project, many trees were felled and transported together with school children. The working processes were documented with aid of Motion Capture technology. – Gemeinsam mit Schülerinnen und Schülern wurden im Rahmen des Sparkling Science Projekts zig Bäume mit der in Hallstatt nachgewiesenen Technik gefällt und anschließend geliefert. Die Arbeitsabläufe wurden zum Teil mit Motion Capture Technik dokumentiert.

Ventilation and Lighting
Sufficient ventilation and lighting are, next to quarrying and transport, two further basic requirements for successful mining. Using plexiglas models of the mine, various experiments concerning air circulation were carried out (VADEANU 2012).
More than 95% of all Hallstatt lightning tapers are made from resin-free fir wood. Since this was established, many different investigational efforts and experiments concerning the tapers have been carried out. The method of using the tapers could be reconstructed (KÖSTELBAUER 2013; BALLNER 2013) and various methods of nitration to raise the flammability of the tapers were tested (SCHIEL 2014).

Diet of the Miners
Investigational efforts and experiments concerning the diet of the miners have long held a fixed place in the research at Hallstatt. Eckart Barth's enthusiasm for

Fig. 9: By pounding pieces of ash wood repeatedly on a hard surface, the individual growth rings can be separated from each other. This flexible and robust material serves as raw material for splint boxes. – Werden Eschenscheite auf einer harten Unterlage geklopft, lösen sich die Jahrringe voneinander und bilden so ein extrem flexibles und hartes Ausgangsmaterial für die Herstellung von Spanschachteln.

cooking and the wealth of remains of human excrement and food found in the mine aided in its taking an important part in our agenda. Ritschert, a type of bean stew that was the main diet of the Hallstatt miners for hundreds of years, was not only reconstructed by Barth (Barth 1992b), but also experimentally tested (Bertieri 2009). The results of investigations concerning the large-scale production of salt pork (Barth, Lobisser 2002; Pucher et al. 2012) have in the meantime achieved a fixed place in the model of Bronze Age Hallstatt mining operations.

A reconstruction of the production of the starting materials for Iron Age wooden boxes successfully demonstrated a technique that has been preserved unchanged in a very small region for over 2500 years. It is quite simple to produce very flexible shavings with the thickness of a tree-ring by hammering ashwood trunk sections (Reschreiter, Winner, Grabner 2013) (*Fig. 9*).

Apart from the ashwood shavings, other ancient woodworking techniques have been preserved in the Hallstatt region to this day. It is hoped that these techniques will be documented and as much as possible, passed down and preserved through the efforts of the Historical Wood Utilization network.

Experiments outside of the mine

In addition to the investigational efforts and experiments that are directly connected to the salt mine, extensive textile record from the mine were examined, cremation experiments were carried out and briquetage and other salt brine boiling experiments also took place. Various pyre construction techniques have been tested as part of the annual public event “Archaeology on the Mountain” as well as in

the Experimental Archaeology university field seminar in Asparn (Pany-Kucera et al. 2013).
Hundreds of extremely well-preserved wool textile fragments from Hallstatt were the starting point for experiments in spinning, weaving, sewing, hemming and dying, some of which were conducted as part of major EU projects (Summarized: Grömer et al. 2013; Hartl et al. 2015).
The experiments concerning the reconstruction of dying techniques for textiles (Hartl et al. 2015) as well as the experiments concerning the production and use of bast ropes were carried out with a view to known techniques from the field of cultural anthropology.

Purpose of investigational efforts and experiments

Reconstructions, investigations and experiments serve many purposes within the Hallstatt project. On the one hand, they permit the acquisition of information about finds and features; on the other hand, they are used extensively for public outreach and as a basis for interdisciplinary research.
Investigation and experiments continue to provide the basis for learning more about the production, use, and efficiency of excavated artifacts. As a first step, staff often get to know the materials used in the mine, be it various types of wood species and its different naturally-occurring forms, or fur and skin, or wool and bronze and how they are processed. Reconstructed devices and tools are put to work in the mines as soon as they are produced. It is important to us that excavators have some degree of familiarity with the possibilities and limitations of the materials used in prehistoric times in the mines. They should also be able to identify traces of processing and use and reconstruct their meaning. It is much easier to excavate or process a find or feature if one has already reconstructed and used comparable artifacts, or can refer to colleagues' similar experiences – according to the principle: one only finds or recognizes that which one already knows (Reschreiter 2015b).
Much of the data gained through investigation and experiments are also used in computer simulations (Kowarik et al. 2009; Kowarik, Reschreiter, Wurzer 2012).

Public outreach

Most of the research done in Hallstatt takes place hidden from the public in the darkness of the mine, or in the storage rooms and workshops of the Natural History Museum. Furthermore, over 90% of our finds come from production waste. As a result they are nondescript, mostly fragmentary grey-brown wood, fur and skin objects or textile fragments. It is only the contextualisation, reconstruction and demonstrations of their use that make it possible to adequately communicate to the public the importance of these unique finds.
Reconstructions are employed in different ways within the broad spectrum of public outreach efforts conducted in conjunction with salt mine research. Since the very first presentation of live prehistoric handiwork at Hallstatt in 1998, the annual public event “Archaeology on the Mountain” has gained a fixed position in the yearly plan. Neither this event nor the public education shows presented on TV concerning the mine work could get along without archaeotechnology and reconstructions. Experimental archaeology also plays an important role in online media, such as in the Hallstatt blogs and on the homepage (Reschreiter et al. 2015; Löw, Poppenwimmer, Reschreiter 2016). Apart from the “media spots”, reconstructions also represent an important feature of the illustration of articles and books (Kern et

AL. 2008) and are put to use regularly at exhibitions (including both travelling and permanent exhibitions).
In the new Salzwelten showplace in the mine (https://www.salzwelten.at/de/hallstatt/bergwerk/) – the so-called Bronze Age Movie Theatre (RESCHREITER 2015a) – reconstructions are used extensively.
For many years, Salzwelten together with the Natural History Museum have offered special tours of selected prehistoric sites in the mine. The introduction to such special programs includes the presentation of reconstructed prehistoric mining devices and allows visitors to try them out.
We have increased our outreach programs to schoolchildren in recent years, in order to better anchor archaeology in the Hallstatt region and to generate more acceptance for archaeological work. These school programs are offered in cooperation with Salzwelten. The first Sparkling Science Project was completed in 2015 (RUDORFER, RESCHREITER 2014; http://holz-fuer-salz.blogspot.co.at/p/uber-das-projekt_16.html).

Depictions of prehistoric life

A sizeable portion of the basic data that are used to create depictions of life in the Bronze Age and Iron Age mine stems from our wide-ranging experiments. Depictions of Bronze Age and Iron Age life are implemented extensively in Hallstatt as part of publicity for scientific work, and are understood to be pictorial applications of the most current scientific mo-

Fig. 10: Anthropological analyses on the skeletons from the Hallstatt cemetery evidence that children, teenagers, women and men were part of a demanding working process. Over the last years the majority of the represented activities were part of experimental series. – Für die ältere Eisenzeit belegen die Analysen der Skelette, dass sowohl Kinder, Jugendliche, Frauen und Männer in den Arbeitsablauf intensive eingebunden waren. Ein Großteil der dargestellten Tätigkeiten war in den letzten Jahren der Gegenstand von Versuchsreihen.

dels (Reschreiter, Pany-Kucera, Gröbner 2013) (*Fig. 10*).
Depictions of life also play a central role in interdisciplinary research (Kowarik, Reschreiter 2015). With the help of depictions of life, new research partners can quickly obtain an overview of the current state of affairs in our field, and comprehend both the most current questions we face and the nature of how various disciplines interlock in the salt mine research environment.

Challenges

The consistent pursuit of experiments and investigational efforts keeps the excavation permanently occupied with new challenges. Integrating quarrying and transport experiments along with the creation of reconstructions into the daily excavation work schedule is as difficult as fulfilling the intention to equip the workshops at a high level. Another difficulty is that fewer and fewer university students have basic experience in work in a manufacturing environment, in tool use or in the use of natural materials. In many cases, it is necessary to teach our young colleagues everything from scratch. However, due to the special requirements of excavations in the mine, multiple years are required for instruction, so enough time is available to educate them.

Goals and Prospects

Our intention is to increase the production of reconstructions and the realisation of investigational efforts and experiments in the next few years. One of our goals is to reconstruct the entire mine work process from the quarrying the salt up to its transport, and to quantify the process as far as possible. To this effect, it will be necessary to append the topics of further varieties of transport along with pick-mining and the breaking off of the heart-shaped Iron Age salt tablets as well as further aspects to our research. All of the data processed is intended to be used as the basis for a comprehensive simulation of salt production. Bronze metal mechanical wear will be included, along with the caloric requirements of miners and resource requirements of the mine. In this way, it is planned to expand the preparations already completed through the Sparkling Science Project. In order to accomplish this ambitious agenda, it will be necessary to make further investment in the education and motivation of our staff. As part of these projects, we plan to assemble a comparative collection of production marks, mechanical wear marks and use marks on wood that will build the foundation for future use-wear analysis.
Films, photos and animated shorts concerning both reconstructions and the work procedure in the prehistoric mine already represent an important part of the public outreach for this unique archaeological site. One of the next goals is to create a digital prehistoric mine that will allow users to experience an interactive virtual flight through its tunnels and caverns and include 3D models of devices and tools.
More films and animated shorts concerning the production and use of devices and tools are also being prepared. We are also planning to expand the use of ethnological films in order to widen the basis for comparative work. Due to the fact that much of the scholarly work on Hallstatt now exists only in the form of unpublished student theses, one of the most urgent goals is to edit a series of publications in which completed theses as well as experimental protocols can be presented.

English translation by K. Renée Albe

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Author
Hans Reschreiter
Natural History Museum Vienna
Prehistoric Department
Burgring 7
1010 Vienna
Austria